C
60
57
8
0.5
op. 1
Biological
& Medical
Serials

Vol. VIII. No. 5. March, 1915.

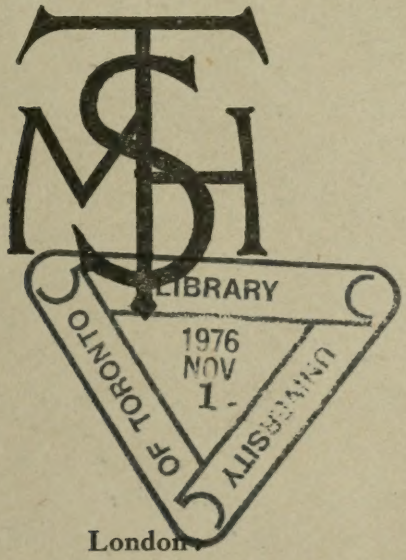
STORAGE

TRANSACTIONS

ROYAL

OF THE

SOCIETY OF TROPICAL MEDICINE AND HYGIENE



London:
SOCIETY OF TROPICAL MEDICINE AND HYGIENE
11 CHANDOS STREET, CAVENDISH SQUARE W. 1

TRANSACTIONS OF THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

MARCH, 1915. VOLUME VIII. No. 5.

CONTENTS.

PAGE

The War and Cholera. By Professor W. J. SIMPSON, C.M.G., M.D. ... 139

Discussion: THE PRESIDENT, Surgeon-General Sir DAVID BRUCE, Sir RONALD ROSS, Fleet-Surgeon P. W. BASSETT-SMITH, Professor W. J. SIMPSON 159

NOTICE OF MEETING.

SESSION 1914-15.

On Friday, May 21st, at 11, Chandos Street, Cavendish Square, W., Short Papers will be contributed on various subjects of Tropical interest, including the following:—

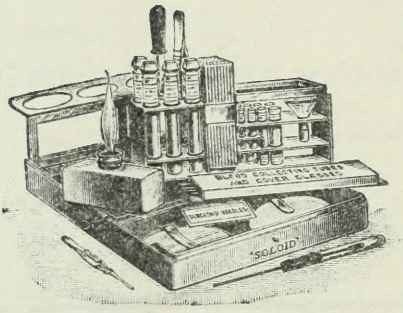
"An Epidemic of African Tick Fever among the Troops in British Somaliland." By R. E. DRAKE-BROCKMAN, M.R.C.S., L.R.C.P.

"Four cases of Bilharziasis under Thymo-Benzol Treatment." By C. M. EKINS, M.R.C.S., L.R.C.P., Government Hospital, Alexandria.

An Aid to Diagnosis of Tropical Diseases

TRADE MARK 'SOLOID' BRAND

Bacteriological Case No. 505



Simplifies bacteriological examinations of blood, pus, sputum, etc.

Contents: Methyl alcohol, absolute alcohol, distilled water, Canada balsam, graduated pipette, forceps, microscopic slides, spirit lamp, glass funnel, watch glasses, needles, filter papers, blood-collecting pipettes, cover slips, sterile swab, 'Soloid' Microscopic Stains. Measurements: 5 × 3¼ × 1⅝ in. Nickel-plated metal with doeskin cover.

Of all Chemists

BURROUGHS WELLCOME & CO.
LONDON

xx 1539

COPYRIGHT

EDITORIAL NOTICES.

The Editor of the TRANSACTIONS will be pleased to receive short papers to be included under the heading of "Notes and Comments," or "Questions," in addition to longer papers on subjects of Tropical nterest, which may be offered for presentation at meetings of the Society. He will also be glad to receive books for review.

Any communications for the Editor should be addressed to THE EDITOR of the TRANSACTIONS of the Society of Tropical Medicine and Hygiene, 11, Chandos Street, Cavendish Square, W.

TRANSACTIONS

OF THE

SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

MARCH, 1915.

VOLUME VIII. No. 5.

Proceedings of a Meeting of the Society on Friday, February 19th, 1915.

SURGEON-GENERAL

SIR R. HAVELOCK CHARLES, G.C.V.O., I.M.S.(R.), *President*, in the Chair.

THE WAR AND CHOLERA.

BY PROFESSOR W. J. SIMPSON, C.M.G., M.D.

The great war, which has brought into conflict ten Powers, and is likely to bring more before it is finished, is an event which has been and is likely to continue to be pregnant with medical problems.

The fierce battles that distinguished the commencement of the war resulted in an enormous number of men being wounded and consequent strain on medical organization and hospitals. The nature and septicity of the wounds inflicted by modern weapons have taxed the ingenuity and skill of the surgeon, and given him much to ponder over in regard to treatment. The continuance of the campaign through an exceptionally wet winter with its mud and its water-logged trenches, the flooded low lands of Flanders and the nerve racking effect of incessant gun fire have offered opportunities to the physician for study and treatment of a variety of diseases, the types of which differ in many respects from those common to civil life.

The absence of scurvy, with its accompanying dysenteries, and the comparative freedom of disease of an epidemic form which the armies have so far enjoyed are remarkable when compared with previous wars.

The immunity in this respect is a matter for congratulation, and is a tribute to the excellency of organization and efficiency of sanitary measures which have been one of the conspicuous features of the war. It would be a mistake, however, to consider that the first six months is a certain index of what will happen during the remainder of a long war, with its changing personnel and conditions, for the problem of the health of the armies is a very complex one, and includes numerous factors possessing singly and together an undetermined value. The season of the year at which the war began, the stimulus and excitement of great battles with their alternating successes, and the efficiency of the commissariat in the supply of food and suitable clothing, are not without their influence in the maintenance of health and the quiescence of epidemic disease. The armies of Germany and Austria will be in a very different physical, mental and material condition in August and the autumn of 1915 or 1916, from what they were in 1914, when victory appeared assured to them. Should epidemics then arise they will not be confined to the particular armies that are first stricken, nor will the civil population in the devastated areas escape.

Let us glance for a moment at some of the conditions that will be favourable for the development and spread of epidemic disease. Scarcity of food will add to the hardships of the civil population that have the misfortune to be within the fighting zone, for in this great siege war the destruction of crops and cattle will place large areas much in the position of besieged towns in olden days, while the rise in the price of food stuffs all round, from the disturbance of ordinary economic conditions, and from the fewer people left to till the ground, will weigh heavily on the poor in every country engaged in the war. The many millions of men in arms must be fed. Their main supply will come from their own country, but they will also take what they can get from the invaded countries.

This generation in Europe has been so accustomed to regular supplies from overland or sea by the quick transit afforded by steam power and undisturbed agricultural pursuits, supplemented by a world commerce, that the famines, dearths and scarcities of an earlier period have been forgotten. Now Central Europe is back, more or less, to a time of isolation plus war on a gigantic scale. The effects of droughts and floods, which assumed importance in times of greater isolation of

countries, have under modern conditions been counterbalanced by an inrush of produce from other lands, so that the third partner of soil and seed, viz., meteorology, has been assigned of late a very secondary position, which could only continue while each country has the world to draw on. When this ceases, as it has done for some parts of Europe, meteorology assumes its old sway. The winter, so far as it has gone, has been a particularly wet one, not only at the seat of war but outside of it. In one respect it has been an advantage, because of filling the wells, but the wet season and the purposely flooded lands of Flanders will render the conservation of food stuffs more difficult than under other circumstances, will accentuate the dearth of food in Europe, and add to the threatening destitution and want. The severe earthquake in Italy, with its 24,000 deaths in one district, will not be without its effect on the physical and mental condition of those in the immediate outskirts of this disaster and who have been subjected to the shock.

A combination of war, flood and earthquake, ending in famine in some localities and in scarcity of food in others, is calculated to be a powerful force favouring in due season the manifestation and spread of epidemic disease, whether it be typhoid fever, small-pox, cerebro-spinal disease, cholera, dysentery, malaria, or plague, should the germs of these be present and be conveyed from place to place by any of the armies or refugees.

CHOLERA INVASIONS OF EUROPE.

Sir WILLIAM OSLER dealt with typhoid fever which is endemic in those parts of the country covering the main seat of the war, and dwelt on the value of inoculation, by which the resisting power of the soldier to this disease could be raised; Dr. GETTINGS gave us a paper on dysentery; and I have been asked to deal with cholera, which is not an endemic disease in Europe or the Mediterranean littoral, but which, nevertheless, from the peculiar circumstances connected with this world-wide war has to be borne in mind and provided against. Although cholera is not an endemic disease in Europe, its visitations in the 19th and 20th centuries have destroyed millions of the population. There have been nine invasions of Europe in a little over 80 years. They have varied considerably in their duration, power of diffusion and severity;

the more lengthy ones being distinguished by important recrudescences. Certain localities in Russia, in the neighbourhood of the Caspian Sea, have been so frequently attacked, that it is a question whether the disease has established an endemic centre there as it has done in the Far East, in Java, Indo-China, and the Philippines. Although these endemic centres are in themselves a potential danger, it is doubtful whether any of them have hitherto given rise to any considerable diffusion of the disease beyond their own boundaries. The source of the nine invasions in Europe, which have corresponded with similar invasions of the countries in the Far East, has generally been traced to India, though not directly, but indirectly, by spreading by land and sea eastwards through the neighbouring countries. On nearly every occasion there has been more than one avenue into Europe, the disease travelling along the chief trade or pilgrim routes in the Near East, and radiating in many directions, but there has generally been one principal gateway by which the epidemic has entered Europe, although almost simultaneously there were often others. The interesting and informing reports of the late Drs. NETTEN, RADCLIFFE and BARRY, and now of Dr. BRUCE LOW, of the Local Government Board, form a valuable record of the later epidemics.

The first pandemic of 1817, in its travels westwards, reached Astrakhan in Russia, in 1823, but went no farther. Its diffusive power, for some reason with which we are not acquainted, had spent itself. It was certainly not from any precautions that were taken. The second reached Astrakhan in 1831, but, more vigorous than the last, continued westwards across the northern continent of Europe and arrived in Northern America in the course of two years from its appearance in Astrakhan. It spread over the whole of Europe and disappeared in 1837. The third reached Astrakhan in 1847, traversed Europe by much the same routes as that of 1831, and reached America at the end of 1848. In both continents it was widely prevalent in 1849, and continued in scattered and localised outbreaks until 1851, when it subsided in Europe, except in Poland, where it recrudesced and subsequently spread to the western provinces of Russia, and down the Vistula to Prussia.

Before the subsidence of this recrudescence, it was reinforced by the fourth invasion, which reached Astrakhan in 1852, and spread over Europe and America, causing in 1854 the most widespread and fatal

epidemic that had afflicted these two continents. After a severe recrudescence in 1859 it disappeared.

The fifth entered Europe by quite a different route from the four first. Instead of *via* Astrakhan it came *via* Constantinople and the southern ports of Europe, introduced in June and July of 1865 by vessels arriving from Alexandria, Egypt, having become infected by returning pilgrims from Mecca. From the southern ports of Europe it dispersed itself over Europe and reached America and Guadeloupe towards the end of the year. The epidemic manifested itself in Western Europe and America until the end of 1868, when it disappeared from these but still lingered in parts of Russia, and during a recrudescence in that country it was imported afresh into France and Germany in 1873 and then finally disappeared.

The sixth arrived in Europe *via* Egypt or the Suez Canal, entering by Marseilles and Toulon in June, 1884. It spread over Europe, chiefly affecting Spain and Italy. Spain lost in 1884 and 1885 no fewer than 180,000 of its people, and Italy about 50,000. For the rest of Europe the extension was very limited and its nature comparatively benign. It reached South America in 1886 and prevailed there extensively during 1886 and 1887. It disappeared from America and Europe at the end of 1887.

The seventh entered Baku, in Russia, in 1892, and spread over Europe, and it was in August there was the great outbreak in Hamburg, when nearly 17,000 of the inhabitants were attacked and about 9,000 died. With recrudescences and fresh local outbreaks it continued in Europe until 1896, when it disappeared.

The eighth arrived at Baku and Astrakhan in the autumn of 1904, but did not become epidemic in Russia until 1907, increasing in force in 1910, when it caused 100,000 deaths in that country, after which it rapidly declined. Beyond Russia, Italy was the only other country in which, in 1910 and 1911, it assumed epidemic proportions. Before the epidemic completely died out a ninth occurred, several parts of Turkey-in-Europe being reinfected by fresh importations from Asia Minor by Turkish troops, and the disease has manifested itself in several parts of the Balkan States, Austria-Hungary and Russia to the present day.

The table gives a short summary of these events :—

Epidemics in Europe.	Principal Entrance gate into Europe.	Interval between each invasion in years.	Number of years continued in Europe.	General characters.
1823	Astrakhan	—	Less than a year	Did not travel farther west than Astrakhan. The Persian and Turkish armies, which were at war with one another, suffered severely.
1830–37	Astrakhan	7	7	Severe and widespread. Very virulent among the Russian and Polish troops. The war was believed to be the great cause of the rapid propagation of cholera in Europe. Great epidemic among the pilgrims at Mecca.
1847–52	Astrakhan	10	6	Severe and widespread. Invaded a larger area of the world's surface than that of 1830-37, and more deadly. Epidemic at Mecca.
1852–59	Astrakhan	nil	8	More severe and widespread than previous epidemics. On its way through Persia it attacked violently troops of the Shah. Cholera affected the troops in the Crimean War. In 1859 it attacked the French troops in Algeria and the Spanish troops in Morocco.
1865–68. Lingered in Russia till 1874	Constantinople and Southern ports of Europe	6	10	Severe but more limited in diffusive power.
1884–87	Marseilles and Toulon	10	4	Less severe and limited.
1892–96	Baku	5	5	Less severe and limited.
1905–12	Baku and Astrakhan	9	8	Comparatively mild and limited.
1912	Constantinople	—	—	Mild and limited. Prevailed among the Turkish, Bulgarian, Greek and Servian troops.

EUROPEAN WARS HAVE GENERALLY BEEN FREE OF CHOLERA.

Cholera was unknown to Europe until after the Napoleonic wars, so that these were free of the disease.

Notwithstanding the number of invasions of cholera since 1823, there

have only been three wars in Europe coincident with its presence in the area of hostilities. The first was the Russo-Polish war in 1831. Cholera was very virulent among the troops, and was believed, by the medical men at the time, to have been materially assisted by the war in its dissemination over Europe. The second was the Crimean war, when cholera prevailed over the whole of Europe; and the third was the Balkan war. Cholera was conveyed to the Crimea in transports from France, but it already prevailed in the Russian and Turkish armies. Both the French and the English armies suffered, and it also affected the fleets. The *Timandra*, carrying sick from the Crimea to the Bosphorus, lost twenty the first night from cholera, and between forty and fifty *en route*. The *Britannia* lost one hundred and fifty men from cholera in ten days. The most important manifestation in the Balkan war was the outbreak behind the Chataldja lines, where it is estimated there were about 18,000 cases. It was conveyed from there into the Bulgarian army, which spread it among the civil population, through which it passed, and finally the Greek and Servian armies were affected.

I have already stated that the war in Poland was believed, at the time, to have added much to the spread of the disease; but the Crimean and Balkan wars were of a local nature, differing in this respect from the present war.

The Egyptian war of 1882-3, though not in Europe, was short in duration and practically over before cholera appeared in Egypt, so that the army of occupation suffered but little, while the civil population lost, in 1883, some 50,000 of its inhabitants.

PRESENT POSITION OF CHOLERA IN RELATION TO THE ARMIES.

The danger of cholera prevailing in the zones of hostilities next August is not a remote one. The present position may be gathered from a glance at the map, which shews the vast range of the conflict, with the chief centres of hostilities, the countries from which the troops are drawn, the invaded areas, and the countries from which cholera prevailed in 1914. In Europe, cholera prevailed in 1914, in Russia in the Province of Podolia; in Hungary in no fewer than fifty-three different centres; in Austria in thirty-nine centres; in Germany in ten, and in Turkey in two. In Asiatic Turkey there were two centres on the Black Sea. There is no information about Persia or Arabia, but they are seldom free

of cholera, especially during the seasons of the pilgrimages. War will not stop the pilgrimages to Mecca and other holy places.

There is every probability of the existing infections in Europe recrudescing, and although they possess the character of having stayed their time, had it not been for the wars of the past two years, yet there is a risk of them acquiring an exaltation in their strength and powers of diffusion by attacking a population enfeebled by hardship and destitution.

There is also always the risk of Turkish, Russian and Indian armies bringing from the East to Persia, Egypt, and Europe, a new and more potent infection, endowed with greater virulence and capacity for spreading than that of 1913 and 1914.

Moving armies are much in the same position as pilgrims and other crowds travelling from place to place. In the Indian armies the long voyage, the excellent ships they come in, and the sanitary precautions taken reduce the risk of importation by sea to a minimum, but even here "carriers" of cholera infection are not totally excluded when thousands have to be transported. The same favourable conditions do not exist on the land routes in Persia and Asia Minor, or wherever the Asiatic troops of the Turks may march. Their condition approximates more to that of the pilgrims. The one hopeful feature against the chances of fresh importation on a large scale is that there are at present no signs of an advancing epidemic from the East. On the contrary, the indications are rather that if there had been no Balkan war, cholera would have disappeared from Europe for a time as it has done in former invasions. That, however, does not justify neglect of precautions and in not being thoroughly prepared for every contingency.

MODES OF TRANSMISSION OF CHOLERA.

One of the most potent factors in the dissemination of cholera from place to place and country to country in times of peace, is the movement of crowds connected with commerce, labour and religion. The great Hindu pilgrimages in India, and the great Mahommedan pilgrimages to Mecca and other sacred shrines, are active agents in the spread of cholera in epidemic form. Many Indian investigators have demonstrated their influence. Some of the exceptional festivals are attended by millions from nearly every part of India, but even the smaller ones are powerful in disseminating the disease, especially those held in the endemic area,

such as at Calcutta and Puri. I remember the great outburst at the Ardhodoya Jog, in Calcutta, in 1891. It is a festival that occurs every 37 years. Cholera broke out at the festival, and on the return journey of the pilgrims I was able to trace the spread of cholera from village to village through which the pilgrims had passed, and the setting up of local epidemics in the villages on the return of the pilgrims to their homes. No disease has had its extension from place to place so thoroughly traced to the lines of human intercourse as cholera. The influence of the Mahommedan pilgrims from different parts of the world to Mecca is well known. Mecca has played a part in most epidemics as a great disseminating centre. In 1883 I had the opportunity of demonstrating that two factors had played the chief rôle in the outbreak of cholera at Damietta, the first town attacked by cholera in Egypt in the epidemic of that year. One was the importation of the disease by pilgrims returning from the Hedjaz, and the other contamination of the river water from which the inhabitants drew their drinking water. The investigation merely confirmed the discovery of SNOW in 1849 and 1854, as to the mode of spread in England, and that it was applicable also to Egypt.

So much is known to-day regarding the transmission of cholera that it will hardly be realised that thirty years ago there were acute controversies on the subject. When I first went to India, in 1886, BRYDEN'S theory of cholera being earth-born and carried by the winds was held by the Sanitary Commissioner with the Government of India, and there were many followers of the same school; the comma bacillus was scouted as the cause of cholera; and MACNAMARA'S views were hotly contested, although he had proved by an accidental experiment that the dejecta of cholera patients in water produced cholera, and that cholera was spread in India by human intercourse and by the drinking of water polluted with cholera dejecta. The late Colonel DUNCAN, I.M.S., had his career spoilt for opposing the views of the Sanitary Commissioner. It was only in the Presidency of Madras that the teaching of Professor PARKES held sway. KOCH'S discovery of the comma bacillus in cholera patients in Egypt, and subsequently confirmed by him on his visit to India, gave a precise method of determining the medium by which the disease spread. KOCH found the comma bacillus in a tank in Calcutta. Later, in that town, during my administration, it was a matter of routine when an outbreak occurred to ascertain which tank or pond contained the bacillus and which not. It

added precision to the inquiry and to the preventive action that followed. At certain seasons of the year cholera bacilli were found in the Hooghly, and in the unfiltered water supplied to the town for bathing platforms and other purposes. In epidemics in Europe it has also been the practice to examine suspected river waters, and often with success. Similarly, as milk was diluted with water from the tanks, the bacillus was often found in the milk. Among Europeans the chief danger from cholera and typhoid fever in Calcutta was the drinking of contaminated and unboiled milk. In an investigation made by HAFFKINE and myself into the etiology of the cholera bacillus in nature, and the results of which were recorded and read by us in a paper at the Indian Medical Congress, held in Calcutta in 1894, we demonstrated that out of forty-six tanks around which cholera existed, comma baccilli were found in forty-two, or 91·3 per cent.; and out of five tanks where cholera had disappeared a month to six weeks previously, comma bacilli were not found in any. This latter conformed to a common experience that if a tank was guarded for three weeks or a month, and further contamination with cholera dejecta prevented, the water was safe to drink. Of fifteen wells examined, nine of which were in cholera infected houses, comma bacilli were only found in one; other agencies were at work here. The air of infected rooms was examined and no commas found, even when the body of the deceased had not been removed and the floor of the hut had been soiled with cholera excreta. In a flour shop, a man attacked with diarrhœa had washed his clothes in a tank behind the premises, and we discovered his clothes still wet lying on a portion of flour exposed for sale. From the flour we obtained a culture of the comma bacillus. Cholera bacilli were also found in the surface drains inside infected houses, and also in the drains leading to tanks.

But comma bacilli were not confined to the waters of the Hooghly or Tolly's Nullah, or the canal in the suburbs of Calcutta, or to tanks or drains. I had frequently observed a marked coincidence between outbreaks of cholera with diarrhœal disease among calves in the neighbourhood of tanks. This led us to examine cows and calves suffering from diarrhœa in the vicinity of cholera outbreaks, with the result that commas were found in the intestines of fatal cases, especially of calves. We also found comma bacilli in the cesspools connected with the cowsheds in which animals were suffering. The

exact connection of these commas to cholera in man we had no opportunity of determining. Further, in some fish examined by me, I found comma bacilli. Similar observations were subsequently made by CUNNINGHAM, REMLINGER and NOURI.

That flies can transport cholera bacilli, which become adherent to the surface of their bodies, was demonstrated by GRASSI, CATANI, TIZZONI and SIMMONDS at an early period. The experiments of SAMTCHENKO, in 1893, in the Kiew laboratory, shewed that cholera micro-organisms could live and multiply within the bodies of flies. Both observations suggested the possibility of contamination of food and the indirect spread of cholera by flies.

In 1894 there was an outbreak of cholera in the Gaya Jail, and Dr. MACRAE, of the Indian Medical Service, traced it to the drinking of milk contaminated by flies from a neighbouring latrine. HAFFKINE isolated the comma bacillus from the milk.

Since the epidemic of 1892, at Hamburg, it has been frequently observed that persons who have been in contact with cholera patients, or living in infected localities, may have cholera bacilli in their intestinal discharges although they are perfectly well and never have had cholera. They are in the same position as persons who have been in contact with diphtheria and get lodged in their throats the diphtheria bacillus, which is harmless to them but dangerous to others.

A certain percentage of those attacked with cholera become chronic "carriers." Early observers have examined the bile of fatal cases and established the fact that the cholera bacillus in a certain percentage of cases is to be found in a pure culture in the bile. Major E. D. GREIG, I.M.S., in 1913, confirmed these observations by investigations he was making at Puri during the pilgrim festival there. Out of 270 post-mortems he found cholera vibrios in the gall bladder in no fewer than eighty cases, and they were not only on the surface of the mucous membrane, but also in the submucous tissue. This fact brings cholera into the same category as typhoid fever as regards the production of chronic cholera carriers. But cholera becomes even more closely allied to typhoid fever in its modes of dissemination when two very important facts, discovered and established by Major E. D. GREIG, are taken into account. The first is that out of fifty-five cases of cholera he found the comma bacillus in the urine of eight

of his patients, and in two of these cases the bacillus was recovered during the stage of convalescence, when the persons were going about their work. The other important fact is that he has found cholera bacilli in the lungs and other organs of some fatal cases of cholera.*

PREVENTIVE MEASURES AND ANTI-CHOLERA INOCULATIONS.

With cholera introduced into the war area, and its capability of spreading by "carriers," by water, and by food or drink contaminated by infected stools or urine, by infected latrines and flies, contaminated boots, clothes, utensils, and hands, there is, when the season of the year and the condition of the population are favourable, a strong probability of much loss from this disease, and it is because of this probability that measures should be at once taken to prepare to combat this disease, and to protect the troops against cholera in Asia Minor, Egypt and Europe.

It is obvious that disinfection of the latrines, and the protection of water supplies or purification of water, are essential parts of any preventive measures. So is the isolation of the sick and the retention of convalescents until free of cholera bacilli in the fæces and urine. The disinfection of the latrines is necessary to prevent the contamination of flies which crowd to these latrines, and to prevent contamination of boots, etc. But as the conditions of warfare often render this difficult, if not impossible, and what may be done in our army may not be done in another, so that the one that takes precautions may suffer owing to neglect on the part of the other, it is important that the soldiers should be also protected by inoculation against cholera, if that inoculation renders them less susceptible of being attacked by the disease.

There can be no doubt that the very extensive experiments with HAFFKINE'S prophylactic against cholera, which were carried out in India on man and not on laboratory animals, twenty years ago, established the fact that these inoculations gave a very high protection against cholera attacks for at least one year. The experience gained in the cholera experiments was the guide to the preparation of the well-known HAFFKINE'S prophylactic for plague, which has proved such a boon to communities attacked with plague. As most of the cholera vaccines—except those used in Upper India—were prepared in my laboratory at Calcutta, and as I had to collect the statistics relating not only to the

* *Indian Journal of Medical Research*, Vol. I., 1913.

experiments in Calcutta, for which I was responsible, but also with reference to the inoculations in different parts of India, in order to report on the subject, I can speak from experience as to their value. HAFFKINE and I received very valuable help from my assistants, especially Dr. R. SEN, Dr. J. N. DUTT, Dr. S. B. GHOSE and Dr. J. J. CHOWDRY, who not only took a very keen interest in the investigation, but also did some excellent work in connection with it. The only disappointing result was connected with the first experiment, when, as a matter of caution, the soldiers of the East Lancashire regiment were inoculated with only weak vaccine in small doses: after the lapse of fourteen months from the time they were inoculated, cholera of a very virulent character attacked the regiment, but even under the unfavourable conditions mentioned, viz.: fourteen months since the inoculation, the use of weak vaccines and small doses, and the type of the attacking cholera particularly virulent, the inoculated suffered to a less degree than the non-inoculated, thus:—

640 non-inoculated soldiers had 120 cases (18·75 per cent.) with 79 deaths (12·34 per cent.).

123 inoculated soldiers had 18 cases (13·55 per cent.) with 13 deaths (9·77 per cent.).

As regards all the other experiments, whether among prisoners in jails, or coolies in camps or tea gardens, or among the general population in the bustees of Calcutta, the protection was of a most marked character. But it was observed that, as a general rule, the period of immunity did not last for more than fourteen months.

It would take too long to give you all the results recorded, but they are to be found in my Annual Report for 1896, and a much fuller account, with details, are given in HAFFKINE'S paper on *Protective Inoculation against Cholera*, published in India in 1913. I shall give you those of Calcutta and of the Cachar tea gardens.

Seven thousand six hundred and ninety persons were inoculated against cholera in twenty-seven months, mostly in those bustees, or collection of huts, in which the poorer people lived, and which were usually visited by cholera year by year. Every effort was made by persuasion to get half the members of the hut inoculated. In some cases we were successful in this respect, in others not. We inoculated in

the huts and then waited events. A complete register, with all details relating to each of the inoculated and the non-inoculated in the hut, was carefully kept, and when a case of cholera was reported investigations were immediately made. Our efforts were greatly aided by an incident which occurred in one of the bustees, which drew the attention of the public to the inoculations. Two fatal cases of cholera occurred in Katal Bagan Bustee, in a population grouped round two tanks. This outbreak led to the inoculation of 116 persons out of 200 residing in the bustee. After the 116 cases were inoculated, nine more cases of cholera, of which seven were fatal, and one case of choleraic diarrhœa, appeared in the bustee. All these ten cases of cholera occurred exclusively among the non-inoculated portion of the inhabitants which formed the minority in the bustee. The following facts, among others of a similar nature, were then observed :—

In Ramdhun Dutt's house, six members out of eight in the family were inoculated between the 31st of March and the 7th of April. On the 9th of April cholera affected one of the members of the family, who subsequently died. This death occurred in one of the two non-inoculated, the six inoculated remaining unaffected.

In Shaik Subratee's house there resided fourteen persons. Two cases of choleraic diarrhœa occurred among them. After this seven out of the fourteen were inoculated. Later one case of choleraic diarrhœa occurred in an adult not inoculated.

In Karam Ali's house, the family consisting of eight members, three were inoculated on the 31st of March, and on the 7th of May one of the five who were not inoculated was affected with cholera and died.

In Munglo Jemadar's house a fatal case of cholera occurred on the 29th of March. On the 31st eleven members of the family out of a total of eighteen were inoculated. It so happened that cholera, again breaking out in the house, attacking four persons, three of whom died, *selected four of the seven not inoculated*, while the eleven inoculated remained perfectly free.

In the twenty-seven months cholera visited seventy-one houses, in which inoculated and non-inoculated persons were living in the same households, and the following table shews the days on which cholera occurred among the non-inoculated and inoculated :—

Amongst the uninoculated members, after — 1, 2, 3, 4, 5, 6, 9, 12, 13, 15, 17, 22, 34, 37, 44, 57, 62, 63, 71, 95, 99, 109, 114, 118, 119, 120, 129, 132, 139, 143, 162, 189, 191, 203, — 219 240, 251, 271, 281, 284, 300, 309, 318, 319, 334, 356, 359, 362, 370, 372, 378, 383, 384, 389, 391, 393, 394, 401, 404, 408, 416, — 421 433, 446, 448, 453, — 459 472, 493, 498, — 512 673, — 688 720, 723, 724, 730, — 735 and 738 days.

and 738 days.

During the first four days after the inoculation, cholera occurred among the inoculated and non-inoculated, though in a smaller degree among the inoculated; after the first four days, there was a period of over a year when there was almost an absolute freedom among the inoculated, while among the non-inoculated in the same houses, cases were occurring during the whole year: after fourteen months cases began gradually to reappear among the inoculated as well as among the non-inoculated.

Including the occurrences of cholera in the inoculated during the first four days, the results for the whole period were as follows:—

654 uninoculated individuals had 71 deaths (10·86 per cent.), while
412 inoculated in the same households had 12 deaths (2·99 per cent.).

The figures shew that notwithstanding the incomplete protective effect of the first four days, and the gradual disappearance of the resistance in those inoculated with doses of weak vaccines only, which a number of the inoculated people received in the earlier days of the experiment, the mortality among the inoculated compared with that of the uninoculated was in the proportion of 1 to 3·63, giving a reduction of mortality of 72·47 per cent., or in other words, where inoculations were performed, and which were subsequently visited by cholera, there occurred for every eleven deaths amongst the uninoculated, three deaths among a similar number of inoculated.

Even in regard to the first four days it was found that the mortality among the inoculated was 1·86 times smaller than among the non-inoculated, and that after that period the inoculated acquired a protection which, for a year at least, rendered them twenty-two times safer than the uninoculated. In HAFFKINE'S pamphlet on *Protective Inoculation against Cholera*, and which covers a larger number of observations in Calcutta and a longer period, viz., thirty-three months instead of twenty-seven, he found that the number of deaths among the inoculated during the first four days was 1·39 times smaller than among the non-inoculated, and that during the period of immunity lasting 412 days or 14 months, the number of deaths among the inoculated was 15·79 times smaller than among the non-inoculated. It was also noticed that in bustees, where large numbers were inoculated, and which usually suffered from cholera, there was in many instances an exceptional freedom from the disease.

Gradually, as more experience was gained, the attenuated vaccine—Vaccine No. I.—was given up and Vaccine No. II., the fixed and strong vaccine, was used instead. The latter was employed in the Durbhanga jail in April, 1896, during the progress of a very fatal epidemic. The prisoners were paraded, and every second man or woman was inoculated. The result was that after the inoculation among a strength of

99 non-inoculated, there were 11 cases (11·11 per cent.) all fatal.

110 inoculated, there were 5 cases (4·55 per cent.) with 3 deaths (2·73 per cent.).

The strong vaccine was used on a large scale on coolies of the Cachar tea gardens who, inoculated and uninoculated, lived together in the same huts. The results are recorded by Dr. ARTHUR POWELL:—

6,549 uninoculated had 198 cases (3·02 per cent.) with 124 deaths (1·89 per cent.).

6,778 inoculated had 27 cases (0·47 per cent.) with 14 deaths (0·24 per cent.).

The two vaccines with which the Indian experiments were made, and which established their protective value, consisted of live cultures. Vaccine II. was a strong vaccine fixed in strength by a process in the laboratory, into which I need not enter, but which is frequently erroneously called KOLLE'S method by those who are not familiar with

the fundamental experiments made by HAFFKINE in India. Vaccine I. was an attenuated preparation of Vaccine II.

Experience with the inoculations indicated that the weak vaccine was not so protective as the strong, and that the strong vaccine, though it caused, when inoculated into a guinea pig, without a preliminary inoculation of the weak vaccine, a necrotic swelling produced no such effect on man. In fact the experiments on man brushed aside many of the theories and deductions formed from similar experiments on laboratory animals. Another experience was that it is not safe to rely on the vaccine giving protection for more than fourteen months, and lastly, that though the protective effect of the weak and strong vaccine protected against attacks of cholera, they had not the same protective effect against death as the two strong vaccines when an inoculated person was attacked with the disease. It was because of the experience gained with the cholera vaccine that a different mode of preparation of the vaccine against plague was adopted, and because plague is a septicæmic disease, it was devitalised. The value of the chemical product thus prepared and used as a prophylactic for plague, both in protecting against attacks of plague and reducing the chances of death when attacked, have been well-established. In cholera, some devitalised preparations of vaccines were used in India, but no opportunity was offered for testing their efficiency. It was the live cultures that were used, and it is generally agreed that they are more efficient than dead cultures. HAFFKINE holds the view that similar experiments are needed to test the value of the devitalised vaccines of cholera, as those which were employed to ascertain the efficacy of the live vaccines of cholera, and the devitalised vaccine of plague.

There can be no doubt that devitalised vaccines, if efficient, are the best for administration on a large scale, and although there has been no scientific proof of their efficiency, based on researches on man, such as have established the value of the living vaccines of cholera and the devitalised vaccines of plague and typhoid fever, yet there are occasions on which they have been used in which evidence of a general character has indicated that they also are of great value and similar in character to those of typhoid and plague. When visiting KITASATO'S laboratory in Japan, in 1902, I found the devitalised cultures of Vaccine II. were being used with what was believed to be satisfactory

results. Over 70,000 people were inoculated with this vaccine. CASTELLANI has used the devitalised vaccines in Ceylon since 1905, combined with those of typhoid fever and paratyphoid A. and B. in one mixture.* This is a combination which saves and eliminates an unnecessary number of inoculations and which at the same time does not produce any antagonistic effect. The devitalised preparations were employed in Petrograd in 1908 and 1909 and in Batavia in 1910 and 1911; over 30,000 people being inoculated in each of these towns. Similarly the devitalised preparations were employed on a large scale by the Greeks during their military operations in Macedonia in 1913. The appearance of the first cases of cholera at Chataldja in the Turkish army, and later in the Bulgarian army, decided the Greek authorities to begin a general vaccination of the army and of the civil population of that part of Macedonia occupied by the Greek army. For this purpose two anti-cholera ambulances were attached to each division of the army. One was a rapidly travelling section containing a well-equipped laboratory and disinfecting stove, under the direction of a medical bacteriologist, and the other a stationary section, under the direction of a medical man, equipped with material necessary for the transport and treatment of twenty-five cholera patients. Some fifty bacteriologists were employed, of whom thirty-five were civil and fifteen military, and the inoculations were performed by the regimental medical officers and the civilian doctors in different locations, who were supplied with material and printed instructions. The organisation and administration of the anti-cholera campaign, both in the army and civil population, was placed in the hands of Professor C. SAVAS working in conjunction with M. MANOUSSOS, the principal medical officer of the army. Professor C. SAVAS gives in the *Bulletin of the Office International D'Hygiène Publique*, of October, 1914, a very full account of the measures taken to carry out anti-cholera inoculations in the army and civil population in the infected area, and the effect they had in checking and suppressing the epidemic.

Approximately half a million persons were inoculated. This included about 150,000 soldiers, 350,000 civilians and refugees in Macedonia, and about 150,000 civilians and refugees in Salonika.

In ten divisions, consisting of 114,805 soldiers, which took part in

* *British Medical Journal*, November 7th, 1914.

the Græco-Bulgarian war, there were only 2,192 cases of cholera (19 per 1000).

The incidence on inoculated and not inoculated was as follows:—

Two vaccinations.	91,224 soldiers had	644 cases	=	7 per 1,000.
One vaccination	14,613	„	618	„	= 42	„
Not vaccinated	8,968	„	834	„	= 93	„

Those vaccinated only once had six times more cholera cases than those vaccinated twice, and those not vaccinated had fourteen times more. If to the non-vaccinated be added ninety-six fulminating cases which are stated to have occurred among them, the ratio rises to 103 per 1,000.

It was reported by the principal medical officers of divisions that as soon as the vaccination of these were finished, cholera disappeared as by enchantment, and only remained sporadic among soldiers sent to fill up vacancies, and who had not been vaccinated, and this though the soldiers remained in localities where cholera was prevailing amongst the civil population and the refugees.

Further, in the first division, specially in which the first cases of cholera occurred, and in which the double vaccination had been completed before hostilities commenced, there were only a few cases of cholera reported, and only among soldiers who had been sent from Athens and had not been vaccinated, whilst the other divisions which co-operated with them, were attacked by the epidemic.

It was noticed also that in the towns and villages a double vaccination of the inhabitants was followed by a sudden decrease and prompt disappearance of the epidemic, and it is to these vaccinations that Professor Savas ascribes the control and suppression of the disease, both in the army and among the civil population of the infected towns, and the protection of Greece from the ravages of cholera when the population was under conditions where other sanitary precautions were difficult, or impossible to adopt.

The success attending these inoculations is similar to that which I have had in regard to plague. In 1913 the whole population of Mombasa, resident and floating, was inoculated during an epidemic of plague, with the result that the disease was effectually stamped out. I had a similar experience in 1908 in West Africa. In both localities pneumonic, as well as bubonic, plague prevailed. The inoculations were,

of course, combined with all other known methods of combating the disease.

Professor Savas attributes to the inoculations the saving of Greece from a serious epidemic ; concludes that 99 per cent. of persons inoculated twice remained refractory to the epidemic ; and classes anti-cholera inoculations among the most efficacious preventatives against cholera.

While recognising the extraordinary good effect which the inoculations had in checking and suppressing cholera in this particular campaign, there is one important point which has to be remembered in order to gauge the power of the inoculations at their true value, and that is that the type of cholera was not of a virulent character except in the ninety-six fulminating cases among the non-inoculated. The vaccines were capable of dealing with the epidemic, but it was a comparatively mild epidemic that was dealt with.

There is much variancy in the virulence of epidemics of cholera. I have seen an epidemic in which the mortality was as high as between 80 and 90 per cent., and I have seen others which have had a mortality of less than 20 per cent. It is important in preparing vaccines against an epidemic to obtain for the inoculations a natural strain of cholera bacillus from as virulent a type of cholera as possible, in order that the immunising effect shall be well above the type of the epidemic, and in order that it can be maintained with ease at a high and fixed state of virulence in the laboratory. Whether the present Russian strain will be the most effective to combat any natural exaltation of epidemics due to recrudescences or importation under the conditions mentioned, may well be a matter of doubt, seeing that since 1911 its virulence and capacity to spread have been diminishing.

I think Castellani's method of mixing the vaccine is well worth consideration, as being practical and convenient. It is not doing anything different from inoculating on one arm with typhoid vaccine and vaccinating on the other at the same time against small pox.

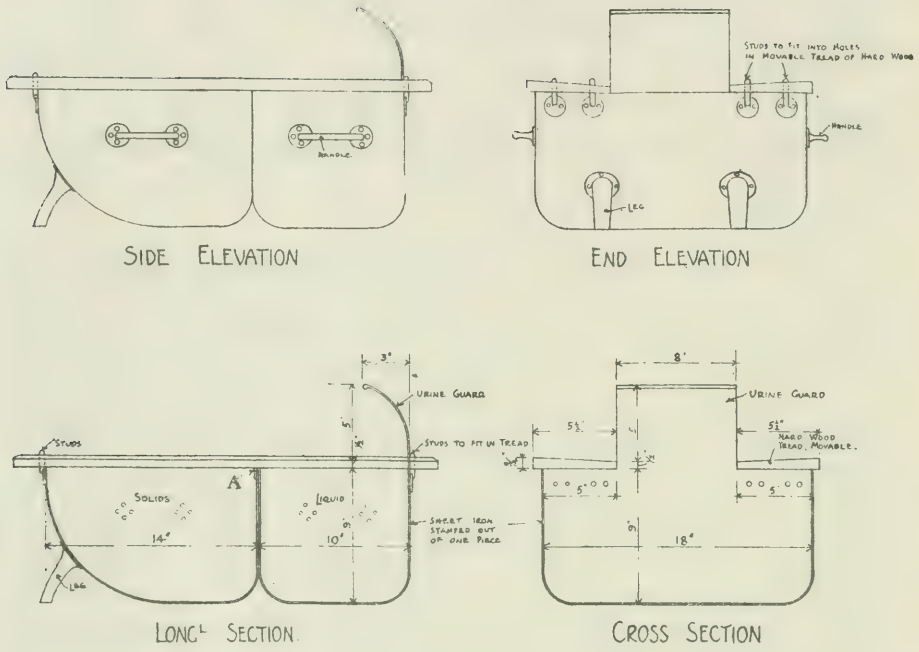
This is not a paper dealing with the treatment of cholera, but before closing I should like to record my opinion that Leonard Rogers's method is a valuable addition to the physician's resources when called upon to treat the disease.

The PRESIDENT: I think that this discourse of Professor SIMPSON'S to-night has been very apropos on account of the condition of affairs in Europe. Professor SIMPSON'S address has brought back to me a great number of memories. In 1894 I was at the Indian Medical Congress when, as he says, he read a paper there. At the same meeting was Dr. ERNEST HART. He came to teach India. He said, quite rightly, you could only eat cholera, or drink cholera, and spoke as if service men in India knew nothing. There were a considerable number in India who had in practice carried out these ideas. They considered that Dr. HART was teaching his grandmother.

With regard to the water borne theory with respect to cholera, I had a striking lesson on the subject. Before I went to Calcutta I was at a certain Station, and in the hospital were some very bad cases of cholera. One of these, at night, escaped from the vigilance of the nurses. There was a very fine well in the compound, from which all the menials derived their water supply. The cholera stricken individual got into that well and spent the night there. He was taken out in the morning alive, and was carried to the Ward. There had been no cholera amongst the subordinate staff. About 24 to 36 hours later there was a virulent outbreak amongst those whose custom it was to use the well water. The well was cleared and disinfected. The outbreak subsided. An example like that, of course, brings the lesson home to one very strongly. That occurred long before Dr. HART came to India.

Professor SIMPSON has not said anything whatever about treatment, except in the last paragraph of his paper. There are certain questions I put to him. First: When, in his opinion, are cholera cases bacilli free? Secondly: In his carrier cases, how is he going to eradicate the vibrios from the gall bladder? Thirdly: regarding vaccination, certain authorities state that you lessen immunity to cholera during the first two days after vaccination. What is Professor SIMPSON'S opinion?

The War and Cholera—These are two points which naturally strike anyone having charge of troops. First, the factors in producing an epidemic; and secondly, the best way to exercise prophylaxis against it. Amongst the factors, it has been put very well that there are five "C's." The *carriers*, two kinds, chronic and healthy. The *climate*, which undoubtedly influences the spread of cholera, because we know that cholera, though introduced frequently into Europe and America, does



COL. KENT'S 'SINGAPORE' PATTERN LATRINE PAN FOR ASIATICS.

Diagram to accompany the President's Discussion on Professor Simpson's Paper on Cholera.

not spread as it does in tropical climates. The *crowds* that Professor SIMPSON spoke of, whether pilgrims, fairs or armies. *Contamination* of food or drink; and *conservancy*—the sins of conservancy.

The next important point is prophylaxis, for the best way to escape death from cholera is not to get it. Professor SIMPSON and I have been through a number of cholera epidemics, and I must say at times it somewhat shatters the nerves, but the point I have always gone on personally, first of all, is to prevent the entry of the bacilli into the body. Drink boiled water, eat hot food. Keep your eating utensils clean, observe the strictest personal cleanliness for the hands, never put them to the mouth. Next, increase the resistance of the body. That is important during an epidemic. Do not go and see cases with an empty stomach. Avoid any tendency to indigestion or diarrhœa. If there is a tendency to it, be content with food of a more simple nature. A most excellent thing to take, I have found, was diluted hydrochloric acid, 20 to 30 drops, three times a day. The third point in prophylaxis is isolate your patients and contacts, carriers and infected objects, and lastly attend to the night soil. There is one point as to night soil. Colonel KENT, R.E., of the War Office, has devised a most excellent form of night soil stool. It is for natives of India. We all know it is much more easy to destroy fæces if the urine is not mixed with it. There are two receptacles, the front one is for the urine and the back for the fæcal matter. The best way of treating fæcal matter is by the systematic use of chlorinated lime or cressol. Boil the urine.

Professor SIMPSON spoke very truly with regard to the relative virulence of epidemics, and in comparing mortality statistics and methods of treatment—do not forget it. Another point is the dose of poison that gets into you. There are few epidemics in which you do not get a little. You eat the small dose, the large dose eats you.

Some time ago I suggested we should have a paper in this Society on differences of opinion on tropical diseases—a resumé of the year's work. Now two points have come up to-night. One of these is with regard to the effect of the bile or the cholera vibrio. Researches reported lately state that the bile is a natural protection against cholera. We have Major GREIG shewing and demonstrating that in the gall bladder the vibrio rests in safety. It lives secluded there; it is in a position not to be attacked by anything, and in a suitable medium for growth.

The other point is with regard to vaccination, whether it lessens immunity.

I am very glad indeed that Professor SIMPSON alluded to Major GREIG's researches. They are of the greatest interest and value, and determine the scientific explanation of the mechanism of the production of carriers. The manner in which the cholera vibrios pass from the intestinal channel to the liver and bilary ducts; also GREIG has well brought out the importance of carriers, demonstrating them as the starters of sporadic cases as well as the possible cause of epidemics, and pointing out that the discharge of the vibrios from the gall bladder is intermittent and not regular.

It was a pleasure to me, personally, to be reminded of former days by Professor SIMPSON to-night, because I think we have both gone through the same time, epidemics of small-pox, plague and cholera. Calcutta is a wonderful city.

Surgeon-General Sir DAVID BRUCE: I have never quite understood why anti-cholera vaccination has not become more popular in India. We do not seem to hear much about it of late years. Is it because it is thought to be a failure? Perhaps Professor SIMPSON will give us some idea as to this.

I think HAFFKINE deserves great credit for having worked out anti-cholera vaccination.

Sir RONALD ROSS: I think I can explain one reason why HAFFKINE'S anti-cholera vaccination has not been employed and heard of so much now. There is another method of preventing cholera, which is known as HANKIN'S method. I had to deal with several outbreaks of cholera in Bangalore in 1896, nearly twenty years ago, and I preferred the HANKIN method to the HAFFKINE method, simply because it was impossible to inoculate a population of 100,000 in a few weeks. I understand there is a proper place for each method. For the natives in India one prefers HANKIN'S method, but in the army in Greece, one prefers HAFFKINE'S method. Each method is applicable in the appropriate case.

Fleet-Surgeon P. W. BASSETT-SMITH: There is just one point I

should like to refer to. Professor SIMPSON spoke about cases occurring on board ship. That, of course, is a point of very great importance to us from a practical point of view. During the summer-time there may be a great deal of movement of troops, and troop-ships will be carrying possibly infected cases. Bearing that in mind, it becomes us to remember the great value of HAFFKINE or KOLLE preparation for producing immunity, and whether it would not be advisable to recommend that those permanently employed on those hospital ships who had to attend on the sick should receive a protective inoculation. Its use might be made compulsory on those ships in the Mediterranean stations. The work is made much more important because one now recognises that the disease is septicæmic in character, so that we have greater reasons for these important methods that should be taken to protect the individual from possible danger from those he may associate with in the form of carriers.

Professor W. J. SIMPSON: I thoroughly appreciate and reciprocate, Mr. President, your kind remarks about our association in Calcutta, bringing back very pleasant memories to both of us.

With regard to the question of how long the bacillus remains in the convalescent: well, that is a difficult matter to say. As a rule, it is about three weeks, but it is not safe to send out a cholera patient without examining the stools at least twice, to ascertain if there are any bacilli, because it has been found that that is the only way of coping with the carriers. There will be a certain percentage of cases in which the bacilli continue for many days—even for fifty-five days—and they have been found after a year. How much longer has not been ascertained.

Then the question was asked how the bacilli could be eradicated from the gall bladder. I am afraid that is a puzzle. It is one of those matters for scientific research. It is not an easy matter to get to the gall bladder, as one knows with regard to typhoid fever, and I know of no medicine at the present time that is able to deal with that. Major GREIG hopes one day to hit upon something to remove the bacilli from the gall bladder, but I am afraid there is nothing in his valuable experiments so far which encourages the hope of a satisfactory solution of the problem.

Then there was another question as to the lowering of immunity

during the first two days. In all the experiments that were made on man, this immunity was not lowered. The experiments on animals indicate there is a lowering of immunity in them, but the fact that in man there is a reduction during the first four days amongst the inoculated, both in mortality and in attacks, when compared with the not inoculated, seems to indicate there is no lowering of immunity at all, but on the contrary a gradual and general rise in immunity up to the fourth day, and after that, this immunity is complete. I know that CALMETTE brushed aside many of the theories and deductions formed from similar experiments on laboratory animals, and others have indicated that there was a lowering of immunity in their experiments on animals, but it was not so in the experiments in India, as I have already stated.

The PRESIDENT: In the Bulgarian war in 1913 it was shewn that it predisposed them to attack for two days after inoculation. The succeeding eight to ten days full protection was obtained. After the second dose there was again loss of immunity followed by full protection.

Professor SIMPSON: I should like to see these experiments carried out in time of peace. In time of war one can only get facts with reference to the larger questions as to whether inoculations give immunity rather than any of these refinements. The Indian experiments were carried out during a time of peace, under specially favourable conditions, with every precaution, supervision, collection, weighing, and verification of facts, which would be quite impossible during a time of war. We inoculated in houses where there were actually cases, and we found that a number of them took cholera, it is true, but it was well within the period of incubation. I take it that this apparent lowering of immunity for two days in the Bulgarian Army is more likely to be explained by those who were inoculated being in the stage of incubating the disease. However, the matter is very interesting, but from our experiments, and from those that have been carried on in times of peace, nothing like that stated as occurring in the Bulgarian Army has been noticed.

I hope I did not convey the idea that the cholera bacillus was not isolated and cultivated in the epidemics in Europe. Immediately after KOCH discovered the bacillus in Egypt in 1883, and cholera occurred in

Europe in 1884, many of the cases were examined for the cholera bacillus, in fact Dr. SHAKESPEARE has written a large book on the subject of cholera in Europe in 1884, and he mentions that in most countries the bacillus was found in cases of cholera, although at the time many scientists were doubtful as to what relation it had to cholera. It was in India where this controversy was keenest and continued for years. KLEIN came to India, and I think his researches rather tended to mislead people at that time.

Cholera inoculations were not given over in India because they were considered to be a failure. It was because plague came on the scene, and everybody was interested in plague, and inoculations against cholera went into the background altogether, but even then inoculations were continued among coolies going to Assam for about ten years with very good effect; the reason for them ultimately being stopped I do not know. It is very likely that the medical men who were interested in the cholera inoculation, such as Colonel VAUGHAN and others, were moved to some other station and the inoculations were dropped. However, I think it was mainly due to plague coming on the scene and absorbing attention.

I think that Fleet-Surgeon BASSETT-SMITH'S suggestion is a good one, with regard to hospital attendants, who certainly ought to be inoculated if there is any cholera, or likely to be any cholera patients come into the hospital. I can recommend inoculation. I have been inoculated against many diseases, and many times. I have been inoculated several times for cholera, and those who have been inoculated against typhoid will know that it is not a very serious operation.

I beg to thank you for the very kind way in which you have received my paper.

ELECTION OF FELLOWS.

The following were duly elected Fellows of the Society :—

Gerald H. Gallaher, L.R.C.P. & S.I., Lagos.

Major Arthur H. Safford, R.A.M.C., London.

EXCHANGES.

Anales de la Academia de Ciencias Medicas Fisicas y Naturales de la Habana.

Annali di Medicina Navale e Coloniale.

Archives de l'Institut Pasteur Tunis.

Arquivos do Instituto Bacteriologico Camara Pestana.

Bulletin Public Health and Marine Hospital Service of the U.S.

Bulletin of the Tropical Diseases Bureau.

Bulletin de la Société de Pathologie Exotique.

Bulletin de la Société Portuguaise des Sciences Naturelles.

Bulletin de l'Academie Royale de Médecine de Belgique.

het Geneeskundig tydschrift voor Nederlandsch-Indie.

Indian Journal of Medical Research.

Johns Hopkins Hospital Bulletin.

Journal of Tropical Medicine and Hygiene.

Journal of Tropical Veterinary Science.

L'Enseignement Medico Mutuel Internationale.

Memorias do Instituto Oswaldo Cruz.

Philippine Journal of Science.

Revue de Médecine et d'Hygiene Tropicales.

Sanidad y Beneficencia.

The American Journal of Tropical Diseases and Preventive Medicine.

Veterinary News.

Yellow Fever Bureau Bulletin.

NOTE.—The above publications lie in the Society's room at 11, Chandos Street, W., and are at the disposal of Fellows.

PUBLISHING NOTICES.

NOTICE TO FELLOWS.

A copy of the "Transactions" will be posted regularly to every Fellow whose subscription is not in arrears during the Session.

Fellows are requested to give early intimation of any change of address, and in case of non-delivery of their copies of the "Transactions," to communicate with the Secretaries as soon as possible. When copies of the "Transactions" are returned by the Post Office, marked "gone away" or "insufficiently directed," no more copies will be posted to that address until further instructions have been received.

All communications should be addressed to—

THE SECRETARIES,
SOCIETY OF TROPICAL MEDICINE AND HYGIENE,
11, CHANDOS STREET, CAVENDISH SQUARE, W.

SALE OF COPIES TO NON-FELLOWS.

Copies of the "Transactions" may be obtained by Non-Fellows from H. K. LEWIS, 136, Gower Street, W., price 3s. 6d. net each issue, or 28s. per annum, postage extra.

Fellows of the Society are reminded that they can only obtain their copies through the Secretaries, as stated above, and not from Mr. LEWIS.

Reprinted by
G. C. M. PRINTING SERVICE LIMITED
43 HUMBERSTONE ROAD, LEICESTER
1952